Mathematical Foundation for AI & DS

(TAD-301)

Unit	Topic
I	**General Vector Spaces:** Introduction to General Vector Spaces, Subspace of a Vector Space, Linear Independence and Basis, Dimension, Properties of a Matrix, solutions to a non-homogeneous system of linear equations.
II	**Linear Transformations:** Introduction to Linear Transformations, Kernel and Range of a Linear Transformation, Rank and Nullity, Inverse Linear Transformations, The Matrix of a Linear Transformation, Composition and Inverse Linear Transformations.
III	**Expectation:** Introduction, Moments, Expectation Based on Multiple Random Variables, Transform Methods, Moments and Transforms of Some Important Distributions (Weibull and Exponential), Computation of Mean Time to Failure, Stochastic Process: Classification of Stochastic Processes, the Bernoulli Process, the Poisson Process and the normal process.
IV	**Concepts of Inference:** Point Estimation, Maximum Likelihood Estimation, Confidence Interval Estimation, Hypothesis Testing, Likelihood Ratio Tests; Inference for Simple Samples; Inferences on Mean (Large Samples), Inferences on Mean (Small Samples), Inferences for Variance.
V	**The least squares Approximation:** The least squares method, The model for simple linear regression, Fitting a line, goodness of fit, Statistical inference with the simple linear regression model, prediction and model validation, Introduction to multiple regression, Multiple regression equation, Statistical inference for multiple regression, diagnosis of fit, multiple regression equation, Statistical inference for linear regression, ANOVA table.

Text Book(s):

- Kishor S. Trivedi, "Probability and Statistics with Reliability", Queuing, and Computer Science Applications, John Wiley & Sons, 2016.
- Amit Agarwal, “Basic Theory and Applications of Statistics” (An Introduction Using R), American Mathematical Society, 2010.
- Kuldeep Singh, Linear Algebra Step by Step, Oxford University Press, 2014.